

SUBLIMINAL WARFARE

ELF
Extremely Low
Frequency Magnetic
Fields.
They affect us all in ways
we may never
consciously realise!

by Dr. Robert Beck

President, United States Psychotronics Association, 1985.

This presentation consisted primarily of a slide presentation with commentary. The text has been extracted from a version of this lecture published in 1978 by Borderland Sciences Research Foundation.

In 1952, German physicist named W.O. Schumann, playing around with math as physicists are prone to do, postulated that the earth - being a good conductor - was surrounded by a good dielectric called air. And around this is another layer of a good conductor known as the ionosphere, the Heaviside Layer, and that this constitutes a potentially resonant system. That means that any energy trapped in this earth-ionosphere cavity - like lightning storms, etc., - will cause it to ring like a bell. But the surprise was that this signal frequency was the identical spectrum of human brain waves. It had to be of irresistible interest to me to build an apparatus which would measure the earth's brain wave, and at the same time measure the Witch Doctor's brain waves, and see if there was a correlation - which we did.

This publication, which is the *Journal of Research of the National Bureau of Standards*, Division of Radio Propagation,

(p.3, Vol. #66, May-June 1962); tells of one of the early efforts where a government study, granted to Drs. Koch and Pitchum at the University of Rhode Island, had made recordings of the earth's brain wave; and those of you who know anything about Encephalography could almost diagnose the patient by these little squiggles. They look identical to human brain waves! (See fig. 1)

We're reading the Magnetic H-wave which is the psychoactive component. Any radio propagation wave has three components: the E-wave which can be picked up by an antenna, the electro-static component, and the magnetic component - the vector is 90 degrees at right angles to it.

So we built apparatus to test the thesis: There are certain people walking among us today - perhaps one person in three thousand - who by dint of heredity, or training, meditation, or whatever it might be, is able to tune in to this magnetic component which is down around one micro-gauss, one millionth of a gauss. Somehow they latch on to this cosmic carrier of information, transduce it into paranormal "seeing" ability.

Now, the brain wave spectra seems to centre around that magic number of 7.8 to 8.0 Hertz (cycles per second). In other words, we know have an objective test to see whether that person is tuning into a paranormal state of consciousness, or whether he is making it up as he goes along.

If we look at these curves at 8 Hz, 7.8 Hz, there is a tremendous node in the earth's brain wave. There's another one at about 14 Hz, etc. Amazing! The same numbers which you get at the alpha-beta border, the alpha wave, beta, etc. Man is a bio-cosmic resonator.

Now what are some of the factors which can alter human moods if this thesis is correct? Sunspot activity. Recall how solar flare activity totally disrupts radio communication on this planet? It also changes the frequency of the Schumann wave. Lunar tides. The same gravity forces that cause tides in our oceans de-tunes the earth ionosphere cavity slightly, changing its frequency. How about this as a solution for "moon madness"?

A lot of previously anecdotal, but very well documented data, is going to seem to fit this model of why is man sensitive to these cosmic events. Here are some photographs of solar flare activity. The earth, drawn to the same scale as some of these tremendous bursts of energy, is this little dot right here. Tremendous bursts of energy from outer space alter the earth's ionospheric cavity, therefore changing the frequency slightly; therefore it can re-tune our nervous systems, electromagnetically. (Ed Note: We don't have Mr.Beck's film strip, but we do have a copy of the classic in this field, Dewey and Dakin's *Cycles, the Science of Prediction*, pub-

SUBLIMINAL WARFARE

lished in 1947 by Henry Holt & Co., New York. Figure 2 is a reproduction of chart 9, page 144)

On page 142, Dewey and Dakin write: "... in 1934, two Harvard research workers, Carlos Garcia-Mata and Felix Shaffner, re-examined the Jevons studies (on crop cycles) and checked them; they ended up with the conclusion that the sunspot phenomena showed no correlation with agricultural production, but - the solar phenomena showed a remarkable correlation with industrial production, business activity, and with stock market prices. Since this particular outcome of these studies apparently left them a little surprised and aghast, the two students threw up their hands and passed the problem over to the biologists and the psychologists." Who weren't particularly interested, we might add.

But Russian physicists were! They later proved in their own way the the 4th Kingdom of Nature, the human kingdom, reacts immediately to the magnetic changes of the sun, and offered this knowledge for the practical and tactical use of the military maniacs in Moscow.

Now we won't go into the physics of the H-Layer and the I-Layer, etc., but basically the ionized particles that are emitted by the sunspot activity eventually arrive at earth, are trapped at the north and south Geomagnetic Poles, and cause all sorts of electromagnetic anomalies. One of the things that we are familiar with that are triggered by this energy coming in from the sun are the Northern Lights, the Aurora Borealis. These reveal the tremendous amount of energy that comes in and ionizes the rare gasses, creating the luminescence, nature's light show.

What if the ancient people realized that on certain days of the year, (the solstices, the equinoxes, etc), these frequencies change? And what if the priesthood decided to build observatories like Stonehenge and the ones all over Central and South America, Europe and England - to predict these so the people could be either

freed or implanted all over again. I don't know the answers to those totally hypothetical questions, but it was terribly important to them to predict these days.

Now man is unique in that the RNA in his brain has a dielectric constant (K) of 140,000. How many engineers are here? Do you realise the significance of that figure? That one little cell, out of billions and billions in your cerebral cortex, can approach the liquid crystal boundaries. It's a quantum transducer that will respond to coherent energies in the neighborhood of one hundredth of a micro-gauss. This has not been suspected until fairly recently. It means that we are not \$2.40 worth of minerals and water - as I learned when I was in the third grade. We are incredibly complex bio-cosmic transducers; and the things that we have been calling mind, or occult, or what have you, are today surrendering to scientific research on a rational basis. It means that we have within us probably one of the most sensitive, quadruple-conversion, super-heterodyne receivers that's ever been developed; and that we can respond to energy levels that almost appear paranormal.

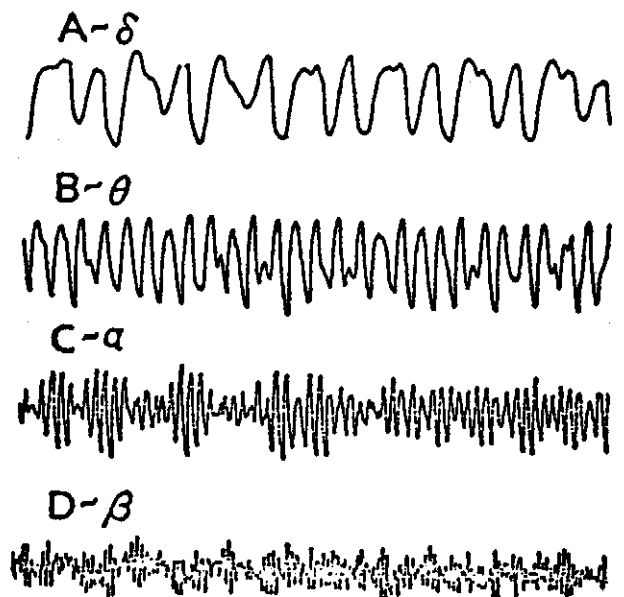
In fact, some of the paperwork that came out of the secret files, and was declassified and hand delivered to me, pointed out that our own Central Intelligence Agency (CIA) in 1975 had given a research grant to Garret Air Research Corporation, El Segundo, California, which Dr. Ed Wortz (one of my buddies in biofeedback research), and Dr. Jed Erkins had predicted the exact mechanism by which the Soviets are manipulating - or can manipulate us globally using this very data; that man, as a bio-cosmic transducer, can respond to things which had previously been called ESP (Extra Sensory Perception) with known, physical mechanisms. That's what it means.

Now, an interesting thing developed. A.S. Pressman, Dept of Physics, Moscow University, did this open literature survey of the work on magnetics and life a number of years ago. Then suddenly

Figure 1.

Typical human brain waves from W. Grey Walter's *The Living Brain*, page 87

"...the frequency of a rhythm is more significant than its amplitude..." Main Types of Brain Rhythms. Records showing the principal wave-forms found in EEG's (a) Delta -- 0.5 to 3.5 cycles per second, (b) Theta -- 1 to 7 c/s, (c) Alpha -- 3 to 13 c/s, (d) Higher Frequency (Beta) -- 14 to 30 c/s.



SUBLIMINAL WARFARE

most of these references - or rather the critical ones in Soviet literature - went underground. Is this trying to tell us something? At the time I did my own literature search - and I have a copy of the bibliography here, in which I found 182 references in the open literature - to the effects of extremely low frequency electro-static and electro-magnetic fields on human performance, mood etc. At that time all of these things were in the open literature. Now one of my students went around to the bio-med library in UCLA not long ago (University of California at Los Angeles) and found a number of these had been sliced out of the text with a razor blade! That leads us to two conclusions: were the kids too broke to put a dime in the Xerox machine? Or had some of these been purposely removed?

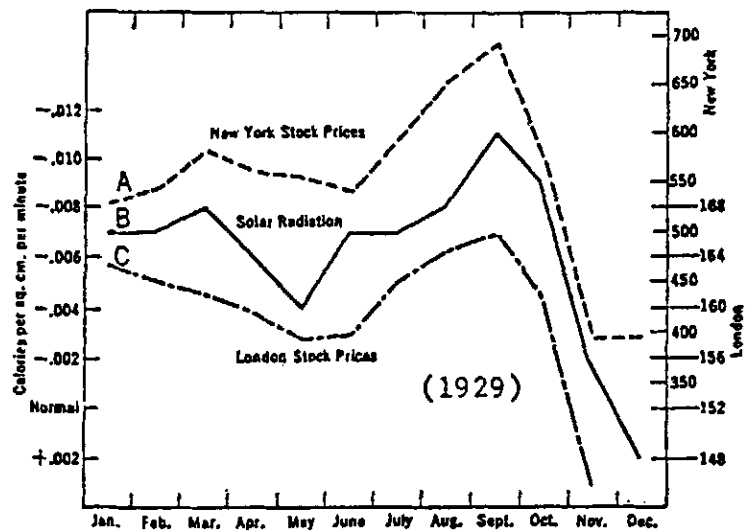
How about the relationship between the mean annual magnetic activity and the number of Sunspots? Again, man is a bio-cosmic transducer. We know we live on a planet that has fairly well predicted (7, 21, 11, etc), cycles. What about this curve of magnetic storms, and mortality from nervous and cardiovascular diseases? A guy with a 25-Watt transmitter - with the Luxembourg effect (which means a circularly polarized antenna aimed at the ionosphere), with a few Hz frequency difference from a 50,000 watt broadcast transmitter can mood-manipulate an area of about 200 square miles. Dangerous? Hell yes!

How about comparison with daily periodic changes and the earth's electric and magnetic fields, and rhythms of living organisms? Circadian rhythms? All of these graphs which you are going to see for the next few minutes, incidentally, are from medically accepted literature, from the medical journals themselves. The dielectric constant of water, the magic transducer.

Okay, here's another one, a paper generated in the *Radio Science Journal of Research* of the National Bureau of Standards. Again, take a look at where the magic number appears to be. That's an 8.0 under the power distribution curve, the same figure that we were finding in the heads of psychics, the medicine men, the witch doctors, the Christian Mystics - they're all the same!

Any of you people know Dr. Ed Maxey, Stanton Maxey in Florida? Okay, about the time I was playing with it he did a very interesting experiment. He took a little coil, a few turns of wire, put it on the floor underneath the operating table and found that by turning this thing on a certain frequencies a large percentage of the people tested had brain wave entrainment. Entrainment simply means that their brain wave - the firing of their neurons - latches onto this magnetic field coming from this little coil putting out micro-gauss. You can't even measure things this low unless you have highly sophisticated equipment. It is invisible. It's tasteless, odorless etc. This is in a paper that he presented to a geophysical society meeting not too long ago. He too came up with the magic number that I have, 7.8 Hertz. He found that exactly four seconds after this field went on, the subject's brain waves would lock on exactly, on frequency and phase.

Figure 2. Solar Radiation and Stock Prices



This was Dr. Polk's original paper, and then this "cop out" about 1975 when the people that were working in this field had to go back, backtrack, and pretend like they had not published their original papers, or seen what they had seen. This is what happens when you get a government grant, boys and girls!

Some good work that was being done at UCLA in their brain research group. Dr. W.R. Adey was on another government grant sponsored by the Office of Naval Research, into the effects of these (in this case - pulsed) very high frequency fields, that were pulsed with a very low frequency modulation. His published papers, and this goes back several years, show that this could influence the brain waves of cats and monkeys; and he didn't talk about the work that was done out there with human beings because by now this was fairly sensitive. They knew it worked. They didn't know why. So a lot of time, money and effort went into finding out what in the human brain was beginning to respond to this.

A few German physicists were looking into the possibility that this may have been the mechanism that we have lived with for thousands of years. The name of this paper is "The Biological Effect of Extremely Low Frequencies in the Atmosphere". In other words, if we live in a natural ELF environment could this possibly be the key and mechanism for mass accidents, mass suicides, etc? All of the people who did this work independently, Tromp in Holland, Koenig in Germany, found: yes - when they went back through the weather records, this had to be the mechanism that caused all of these admissions to psychiatric hospitals on certain dates, all of these homicides. The data is beginning to become massive.

James R. Hamer - or "Hammer". He was working with human subjects, and he has disappeared, as have a few others. He did some extremely interesting work, and this was way back in 1968. At that time he was with the Space Biology Laboratory Brain Research Institute, University of California. The rest of his papers that I managed to gather about ten years ago are now classified.

SUBLIMINAL WARFARE

You can't get them for love or money. Hamer found that in a 9Hz signal the reaction time was definitely shortened. You were more alert. If you changed that signal down a few cycles per second, 3Hz to 5Hz, look what happens to the reaction time. This applies to human beings, monkeys, cats, - apparently all life forms that have brain waves.

Let's get out of here and into other things. Solar activity and incidence of cerebral spinal meningitis. Tom Bearden was talking about carrier possibilities? We don't know whether the waves lower your resistance, or you can actually put the information on them and it is recreated inside the nervous system. Crest days of weather and the relation to sun spots and magnetic disturbances, etc. Mortality, diseases of the nervous system and the lower curve of sun spot activity. In other words, we are looking here at natural ELF phenomena before it began being manipulated. Sun spots and earth's magnetic activity. Again - epidemic meningitis.

Okay, now it gets really interesting. Socio-political mass disturbances, 1923 to 1927, in Europe, related to Full Moon axis.

Remember, the full moon modifies the tides. It modifies these frequencies. In this case the tides are in the Ionosphere and the Heaviside Layer and their position above the earth. Double daily deaths from angina pectoris, and combined groups on the Lunar axis. What if we could manipulate this? Whole populations would be subject. Tuberculosis. Does it influence those germs, those little microbes as well? I don't know, but there it is, positive correlation. Cholera in Russia, from 1823 to 1923, versus solar activity in the same period.

Our first attempt at manufacturing psychics and radionics operators and healers was to put these little light bulbs in an empty eyeglass frame. On the left is an incandescent bulb and on the right is a little cold cathode indicator, like on your FM radio tuner. We flashed these little lights in real time to the Schumann resonance (we picked the Schumann resonance up on a coil), filtered out everything except that wave to which he psychics would entrain and fed them this little flickering light.

If you flash a light in a person's face you get an evoked potential in the occipital cortex. That's the photic response. And you know that if that is at a certain frequency you are going to turn that person on to epilepsy. But, if you put in a beneficial frequency, you can probably cause an evoked response of the brain wave at that frequency. Now that was marvelous, except for one thing. It takes about one hundred milliseconds from the time that light flashes for the signal to cause an evoked potential, and that hundred milliseconds varies for most human beings. In other words, you can test IQ with this little box. The longer it takes that flash to get out here as an electrical signal the dumber that person is because the slower his system is responding.

After we found that this thing could alter moods, the questions came up: Is this hypnosis? Suggestion? Am I a magician? Am I doing it? So it occurred to me that I'd carry this thing around with me in my pocket. Now, I'm a bachelor. I've been divorced for twenty-some years; so I eat out three meals a day. So when I went to Denny's Coffee on Sunset Boulevard I put this thing in my pocket, and occasionally I set it at a specific frequency that I'm not going to mention - because I've been asked not to by the people who can ask other people not to do things.

And pretty soon the waitress would start dropping coffee into the laps of patrons. The babies would start screaming. People within a 10 or 12 foot radius (that's a 20 foot room), would begin freaking out. I'd surreptitiously turn this thing to two Hz higher in frequency. Hahhhhhh (a simulated sigh of relief), you could hear the room calm down. If you had a pocket Radio Shack decibel meter, the cocktail level effect, the volume of the conversation will drop, noticeably, in decibels.

Any of you wake up about 4am and can't get back to sleep until sunrise? Okay, you know why?

We've been getting some very strong Russian transmissions. There is a particular anomaly that's the same as the Dawn Chorus - if you're familiar with atmospheric propagation research. It makes you particularly vulnerable at that time. Notice on this top curve, this 8Hz, the thing on which we want to latch if we're pure, spiritual and psychic - whatever that means. Four o'clock in the morning the bottom drops out and whatever is left is going to get you baby!

Anyway, when Dr. Andrija Puharich was out here (in California) and

Kathleen Joyce and I hosted him, we showed him the apparatus. This is probably the first he had heard of the psycho-physiological effects of the ELF fields; and I recall on your living room floor Kathleen, where he flexed his muscle near the coil, saw the spike readout on the oscilloscope, and realized that we finally had a detector in human captivity that could see micro-gauss levels. In other words his EMG, the few micro-volts of potential, firing through the nerve impulses, through the conductive layers of his skin, was creating enough of a magnetic field to read out on this thing.

He got very excited, so we began showing him some of my research dating back for about the last eight years, and he decided that this was important enough to take back to the United Nations. So he contacted the chap who really runs the government. This man has survived about the last five administrations. He must remain nameless because he is in a very low-profile position. I can assure you he is no-one that you have ever heard about or read about in newspapers. They sent me an airline ticket and invited me to come back to the United Nations.

But Russian physicists were!
They later proved ... the human
kingdom reacts immediately to the
magnetic changes of the sun, and
offered this knowledge for the
practical and tactical use of
the military maniacs
in Moscow.

SUBLIMINAL WARFARE

Dr. Puharich and I were supposed to have about an hour. It ran into a two and a half hour briefing. Kurt Waldheim (Secretary General of the UN) was out of the country at the time, so our host and chap that we informed was the number two man in the United Nations, Rudi himself.

Now, the experiments which caused all of the excitement. Any of you guys ever been in Ossining, New York and seen this Faraday Cage? (The home of Dr. Andrija Puharich, 87 Hawkins Ave, about 40 miles north of New York city). It was probably the most sophisticated cage in captivity. It had three layer of copper and three layers of soft iron. In other words this is H wave shielding, and copper shielding for the E wave Faraday Cage. The thing probably has as much attenuation as the one at MIT (Massachusetts Institute of Technology) the triple new metal cage.

Okay, what we did here, we took this little box. Let's break it out here. This box has been disarmed. It is only mildly psychoactive. We did this at the request of the people who tell you to do things, for damn good reasons. We placed it outside the Faraday Cage. We sealed it up. Incidentally, the pickup, the magnetic pickup coil, is over here in this plastic garbage can filled with sand, to act as a microseismic damper - so that we weren't seeing quite as much vibration. We worked with several subjects and this little box was run by one of Dr. Puharich's secretaries, outside. She was told to turn the dial a little bit. Turn it on. Don't tell us what's happening. Turn it off. Turn the dial to another number. Turn it on. Turn it off. Total double blind. No one inside the cage knew what was going to happen or when it was going to happen.

The subject's brain waves were going from one channel on a chart recorder, with zero cross-talk. The other chart, with a tape recorder, was going to a magnetic pickup; so we could compare the brain waves of the subjects with what was happening magnetically inside of this absolutely airtight, secure environment. The chart readings - the one at the top and bottom were 180 degree changes of the magnetic pickup. The centre portion of that chart was the human subject's brain waves. Over the range of 6Hz to 14Hz, with some subjects there was 100% entrainment, of frequency and phase. Get that!

They locked on total! A little box the size of a package of cigarettes, when it uses the neural frequency principle can entrain the brain waves of a subject inside a totally shielded room, *without his knowledge, consent etc.* That's what this is all about.

What we're saying here by entrainment - if you look at the shape of this wave, they all fall on the same time rate. Starting from half a second to four seconds after the box goes on, the brain waves, the neurons, are being totally driven by this little magnetic oscillator. It is down below 25 nano-Teslas at the source. A nano is one bil-

lionth of one Tesla. A Tesla is ten to the fourth gauss.

Our government was playing at that time - God, I guess, with the multi-billion dollar Project Sanguine. Their purpose was to communicate with submarines under water, with ELF magnetic fields. The project was kicked out of Wisconsin, Michigan, and a few other places by people who had a certain nervousness about environmental disruption. They were trying to use power lines as antenna systems, surreptitiously.

Back in March, the 26th and 27th this year (1978) a chap named Mike Theole, who is a journalist for the Eugene, *Oregon Register Guard*, decided to take his life into his hands and write about some of these things I have some copies of these and many, many other articles that appeared in the public press prior to the time of the

total news blackout. There were a few articles for a few days. A day after this one there were the denials, by the FCC, the EPA, etc. "Mystery Radio Signals May Cause Illness". Hell! They were totally disrupting left and right (brain) hemisphere synchronisation!

People who had never any tendency toward epilepsy, and had no hereditary tendencies in this direction - were going slightly unconscious. According to Marshall Van Ert, there was a two mile stretch of perfectly clear highway where there had been four deaths in about a week. People were

simply driving their cars off the road or into a telephone pole, or into oncoming traffic.

These are not apocryphal stories. These are a matter of public health records. It's in Los Angeles now at about 25 microgauss, and yes, it's spreading. Now the reason that Eugene, Oregon, is particularly toxic is because there is an 800 mile long antenna terminating up there, called the Bonneville Power Authority transmission line. I guess some of you engineers have heard of this thing. They are generating current and sending it down to California as direct current, 340,000 Volts. A DC line is an absolutely perfect, long wire antenna. In fact it would be highly attractive to people who couldn't launch Project Sanguine to use that as our own transmission system, at 2.2Hz.

The next thing was that the power grid was identified as the source of the signal. Any high school kid can tell you that any long wire hanging out there in space can act as an antenna and pick up all the other signals that are being transmitted and re-radiate them. Okay? Even if our Navy is fooling around with long wires as a substitute for Sanguine antennas that had been ostensibly kicked out of several states. They traced the signal and it was strongest around power grids. So what else is new?

These are some of the newspaper clippings that are in the archives. Now, they created such an outrage among everyone who

A guy with a 25-Watt transmitter with the Luxembourg effect, with a few Hz frequency difference from a 50,000W broadcast transmitter, can mood-manipulate an area of about 200 square miles. Dangerous? Hell, yes!

SUBLIMINAL WARFARE

graduated from high school that the FCC itself (Federal Communications Commission) had to back off from this embarrassing, pseudo-solution.

"Could they be having one frequency which they want to work with and the others are just to mislead us?" (asks a listener).

Yes, (replies Dr. Beck), they have phantom frequencies. They are reconstructing heterodynes. Let me tell you why we're getting it and they are not: We are on a 60Hz power grid. They are on a 50Hz power grid. Get that? That's why they're immune. Every civilised industrial centre in the Western world - except one little segment still, near Chicago which is on direct current - and one which is on, I think 50Hz in Arizona, is a potential reradiating weapon of this psychotronic ELF field. In other words, why should they build antennas, re-radiating systems, when all of us have 110Volt systems in our homes; and we are also served with gas pipes, miles and miles of conductors, cold water pipes etc.

"Is there a quick explanation of why 60 cycles will pick it up instead of 50?" (asks someone)

Right. It's a harmonic! (replies Dr. Beck, and turns on his recording of the audio part of the Russian broadcast) at 5.340MegaHertz.

The growl was because we have a voltage control, or rather the VFO on the receiver. That was at 5.340MegaHertz, and we were listening to - in other words, since you cannot hear the fundamental (the actual ELF wave) we have the local oscillator on the super-heterodyne receiver running. It is a global problem. Incidentally, for the engineers again, the attenuation rate of this signal will go around the earth 4.5 times before it is down a half of its original value. Nikola Tesla was right. With some of these frequencies you can excite the earth ionosphere cavity, as though it is a huge bell, and ring it! In other words, the Russians have a thing here which cannot be stopped. It's practically not attenuable by anything that we are familiar with in physics.

Okay, now a lot of this is resonance. What we don't know is how much of this is being originated domestically? How much of it is a second or third order harmonic effect? And what the real and what the virtual parameters are actually engendering? But meanwhile, from the standard textbook of physics, if we look at the E wave as being standard propagation wave form - as being parallel with this screen - the B wave, or H wave, the magnetic vector, is at right angles to this and has to accompany it.

When you strip off the E wave by shielding, by natural attenuation, you still have that H wave left; and that is the one against which you cannot shield. It goes right through you, everything else, and can trip certain neurons in your head.

This report is from a previously classified document done by Dr. Wartz and Dr. Erkins, of Garret Air Research for the CIA showing the "windows" that could be the stimulus for ESP, paranormal, Russian psychotronic research. Does that look familiar? If you move that down about 2Hz, you ain't got a psychic, you got an epileptic!

Some of the propagation paths of the various nodes. The whole earth ionosphere cavity rings like a bell. At certain frequencies you can put some energy in here and under the same conditions get the

same, or even a little more out, somewhere else. Tesla was right.

A little Soviet loveletter, U.S. Patent, Nov.20th 1973, Apparatus For the Treatment of Neuropsychic and Somatic Diseases with Heat, Light, Sound and Electromagnetic Radiation - a trial balloon to see how much we knew about what they were doing. It's Patent #3773049, and among all these words they hid their little gift, which you'll come across when you read the whole patent.

Apparently, certain neurons in the cerebral cortex act a frequency modulating discriminators. Any of you guys who have played around with radio know that you have a crystal set, and you hear several stations simultaneously, you get a garble. They are all overlapped. You can't sort them out; but the frequency modulation discriminator will latch onto the highest amplitude signal in the environment, override the others, and you'll hear that. If you are listening to Police Radio and a loud station comes in, overriding the other, you'll get one or the other. There's very little crosstalk. So what this thing does basically is that it puts out a little magnetic H wave field with a spike wave which we don't like. We like to work with a different wave form that I don't want to talk about. But this thing is apparently mildly psychoactive, but not nearly as psychoactive as the ones they used for the tests in Los Angeles, the ones at the United Nations, and Ossining, New York.

Now, what I'd like to point out to you is that in this very narrow frequency spectrum corresponding to the Alpha-Theta border of brainwaves, you can change the excitation frequency by a fraction of a Hertz, and have an entirely different reaction. Now this was a big surprise. This is the thing that was not anticipated any more than the little germs were before Von Leeuwenhoek and Pasteur.

One reason I feel that this effect has been missed by other researchers who were working with gross frequency inputs is that they were not defining their frequencies down to a hundredth of a Hertz. Now there's a tremendous amount of a supportive evidence in the neuro-physiological literature that certain molecules in our brain, with dielectric constants of over 140,000 and other inductive capacitor parameters, act as long chain, semi-liquid crystal dipoles that are extremely sensitive to coherent frequencies.

Where I think I have done original work is in building systems that can go out to that second, third and fourth decimal place, tak-

